

**Abstract for 2002 ESA Conference on Spacecraft Structures, Materials, and  
Mechanical Testing**

**GALEX Telescope Vibration Response Reduction**

Michelle Coleman  
Jet Propulsion Laboratory  
Email: [Michelle.R.Coleman@jpl.nasa.gov](mailto:Michelle.R.Coleman@jpl.nasa.gov)  
Telephone: 818-354-4563

GALEX, Galaxy Evolution Explorer, is a space UV imaging and spectroscopic earth orbiting mission, which will map the history of star formation. In addition, GALEX will perform the first ultraviolet all-sky imaging survey and will launch in July 2002.

The GALEX Instrument, which consists of a Telescope, an optical wheel assembly, UV detectors, and support structure, was initially subjected to random vibration testing in October 2000. The Telescope secondary mirror exhibited a high dynamic amplification causing the peak response to far exceed design capability. In addition, the Telescope showed signs of misalignment after vibration testing. Although the testing included force limiting, the Telescope local lateral mode, which produced the high response, was unaffected by the force limiting due to the low mass of the secondary mirror. A manual 20 dB notch in the input was needed to maintain a peak response of the secondary mirror below the 30 g design capability. This notch was a lien against the qualification of the Instrument.

Numerous analytical studies were investigated to reduce the Telescope response in both the Instrument level and Spacecraft level tests. It was determined that by softening the Instrument support bipods and adding constrained layer damping, the Telescope secondary mirror response at the Instrument and Spacecraft level testing could be significantly reduced. The response reduction relied on aligning the global mode of the Spacecraft and the Instrument/Telescope local modes such that force limiting would reduce the input at the base. The addition of the constrained layer damping on the Instrument support bipods was intended to further reduce the Telescope response.

The GALEX Instrument, with the new Instrument composite support bipods and constrained layer damping, was random vibration tested again in June 2001. As a result of the testing, the finite element model predicted analytical frequencies were verified. The Telescope secondary mirror experienced less than 30 g's peak lateral response using force limiting only. The Instrument was successfully qualified.

In January 2002, the GALEX Spacecraft was subjected to random vibration testing with force limiting. The finite element model correctly predicted the lateral frequencies and Telescope response. The Telescope secondary mirror experienced less than 20 g's peak response in the lateral directions. As a result, the GALEX Spacecraft was successfully tested to Protoflight vibration levels.